National Fire Plan
Research and Development Projects Funded
FY 2001

TOPIC B (Rehab): $3,175,000 (out of $3,000,00 planned)

Hydrologic and Geomorphic Consequences of Wildfire and Fuels Management Options in Southwest Forest and Woodland Ecosystems
RMRS-FLG-3 Bi $500,000

Testing the Effectiveness of Postfire Emergency Rehabilitation Treatments in the West
PSW-4403-5 Bi $500,000

Predicting potential invasion and spread of invasive species following fuel reduction treatments and post-fire disturbance in the interior Columbia River Basin
PNW-6 Bi $500,000

Development, Performance, Classification, Seeding, and Availability of Native Plant Materials for Sagebrush Steppe and Pinyon-Juniper Community Restoration
RMRS-PRV-2 Bii $500,000

Dynamics of Weed Invasions and Fire in the Northern Rockies
RMRS-MSO-9 Bii $150,000

Effects of Wildfire and Fire-Management Options on Invasive and Exotic Weeds, Insects, and Pathogens in the Southwest
RMRS-FLG-5 Bii $500,000

Determining the Environmental and Ecological Factors that Make Great Basin Watersheds Susceptible to Invasive Plant Species
RMRS-RNO-3 Bii $150,000

Patterns of White Pine Regeneration After Fire and its Implications for Forest Establishment and Spread of White Pine Blister Rust
RMRS-FTC-3 Bii $175,000

Evaluating the Role of Grassland Fire in Southwestern Steppe, Colorado Plateau, and Chihuahuan Desert Grasslands to Manage Exotic and Woody Plants
RMRS-ABQ-5 Bii $200,000

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Station: **RMRS**

Proposal code: **RMRS-FLG–3**

Topic(s): **B.i., B.ii, C.iii., C.iv.**

Proposal title: ***Hydrologic and geomorphic consequences of wildfire and fuels management options in Southwest forest and woodland ecosystems***

Other proposals to which this is linked: **RMRS–FLG–1, 2, 4, 5; RMRS- MCW-1a, 1b; PNW-7, 8; PSW-4403-4, 8**

RWU and location(s): **RMRS-4302, 4152, 4156, 4251, 4651, (all Flagstaff)**

Description:

- **Research or development question, issues, or need: From 1910 to 1992, wildfires burned on average less than 40,000 acres/year in the Southwest. Since 1992, large wildland fires have consumed 2,900,0000 acres. For five of these years (1993-1996 and 2000), the average annual acreage burned exceeded 480,000. Clearly, ecosystems in the Southwest are at great risk in regard to wildfire. A better understanding of edaphic, geomorphic, and hydrologic impacts due to wildfire and fuels reduction is extremely important to reduce this threat.**

Post-fire peak flood flow potentials reach levels 10 to 10,000 greater than pre-fire levels. Burned Area Emergency Rehabilitation (BAER) focus is stabilization of these watersheds following wildfires. At present no systematic method for predicting the magnitude of post-fire floods and concomitant soil erosion, landslides and debris flow events is available. Integration of hydrologic and geomorphic factors is critical in providing risk assessment and monitoring of post-fire mitigation treatments that affect soil erosion, chemistry, and productivity. Reversing this trend in wildfire will require an interdisciplinary approach to fuels reduction and forest health restoration treatments at various temporal and spatial scales.

- **Research and development approach: Research resources are needed to document erosion, flood peakflow, watershed condition, and aquatic resource responses after wildfires to provide decision support for BAER teams. Research personnel equipped to monitor post-fire rehabilitation will provide decision support for wildfire management needs in real time. Additionally, an experimental approach will link previous scientific work to replicate plots with different fuels management options located across the Southwest. These studies (completed, in-progress, and new) will examine key watershed responses to different treatments at a hierarchy of spatial scales. This information will drive predictive models capable of providing managers with decision support. Integration of exotic plant, threatened and endangered species, wildlife, vegetation, forest insect pests and pathogens into the decision support system will require interdisciplinary coordination. The hydrologist/geomorphologist's role is linking hydrologic and soil responses with the above factors over varying temporal and spatial scales. The research approach is a long-term effort with iterative short-term evaluations to provide decision support for**

management in an adaptive framework as treatments are applied to regional landscapes and wildfires occur.

- **Outcomes or products:**
- **First year: Provide existing, but readily unavailable wildfire severity data. Select study sites and develop protocols with cooperating units. Organize workshops to determine research focus areas. Begin development of post-fire flood risk assessments. Assemble wildfire response team and necessary equipment.**
- **Second year: Collect on-site data during the wildfire season. Collect erosion and watershed condition data on sites identified for collaborative research. Make presentations at technical workshops and scientific conferences. Develop GIS-linked erosion and flood flow prediction tools.**
- **Three to Five years out: Continue data collection and analysis. Transfer technology to resource managers through workshops, advisory committees, and web sites. Develop decision support models on post-fire and fuels reduction treatment outcomes. Publish manuscripts in scientific journals, plus station and technical publications.**

Staffing needs by series and grade:

Existing workforce: Dr. Daniel Neary, GS-470-15 Supvry. Res. Soil Scientist; Steven Overby, GS-470-11 Soil Scientist.

New position(s): 1 SY, GS-1315-11/14 Research Hydrologist/Geomorphologist; 4 TY, GS-1316-5/9 Hydrologic Technicians.

Description of skills required: **A Research Hydrologist/Geomorphologist and support technicians are necessary to analyze site, stand, and landscape-scale watershed and soil effects following fires and fuels reduction treatments. This information is critical for advising BAER teams, and Forest and Regional ecologists dealing with fuel reduction, soil quality, watershed condition, riparian restoration, threatened and endangered species, and invasive weeds.**

Potential Partners: **Research collaborators: Fire Science Labs Missoula, MT and Riverside, CA; Forestry Sciences Labs Boise and Moscow, ID, Corvallis, OR; Univ. of Arizona, Northern Arizona Univ., Ariz. State Univ., Univ. of New Mexico, and New Mexico State Univ.; US Army Topographic Engineering Center, DOE Los Alamos National Laboratory, USGS BRD, and The Nature Conservancy. Partners include USFS NF & FHP in Regions 2, 3, and 4, BLM, BIA, USFWS, NPS, NRCS, Grand Canyon Forests Partnership, SW Forest Alliance, Forestry Divisions in AZ, NM, UT, and CO, Land/Game & Fish Depts. AZ and NM, NM Depts. of Nat. Res. & Agr., AZ and Four-Corners Sustainable Forests Partnership.**

Funding requested: **$500,000/year**

Team Leader: **Dan Neary, Res. Soil Scientist/Project Leader RMRS-4302**
Phone: **520-556-2176**
E-mail: **dneary@fs.fed.us**

Station: **Pacific Southwest Research Station (PSW)**

Proposal Code: **PSW-4403-5**

Topic: **B-i**

Proposal Title: **Testing the Effectiveness of Postfire Emergency Rehabilitation Treatments in the West**

Other Proposals to which this is Linked: **RMRS-FLG-3, RMRS-FLG-5, PSW-4403-7, PSW-4403-5**

RWU: **PSW-4403, Riverside, CA; RMRS-4702, Moscow, ID; & RMRS-4302, Flagstaff, AZ**

Description:

Research or Development Question, Issue, or Need: **A recent review of burned area emergency rehabilitation (BAER) practices (RMRS-GTR-63) found that little research or quantitative effectiveness monitoring has been conducted on most postfire rehabilitation treatments. Meanwhile, expenditures for postfire rehabilitation have increased dramatically as more lives and property are threatened by the aftereffects of fires at the wildland-urban interface. High-cost hillslope treatments such as contour-felled logs (log erosion barriers, log terraces) and straw wattles are increasingly being used to protect watersheds after severe wildfire. Based on expenditures over the past 10 years, contour felling operations have been the largest single burn rehabilitation investment. However, the effectiveness of this treatment is unknown. Similarly, the effectiveness of other expensive BAER treatments, such as shallow contour trenching, surface raking, straw wattles, or seeding have had virtually no study. Quantitative evaluation of these emergency rehabilitation treatments is needed to determine if they effectively reduce sediment movement and water output from burned areas and if any reductions realized are cost-effective.**

Research and Development Approach: **To evaluate the effectiveness of emergency watershed treatments, runoff and sediment yield from treated and untreated hillslopes must be compared with sufficient replication of treatments to obtain statistically valid results. Although emergency funding can now be made available to do effectiveness monitoring of BAER treatments (up to 10% of treatment costs), the type of validation monitoring – or research – that we feel is needed is not generally allowed or affordable solely by this mechanism. Cooperation between National Forest Systems (NFS) and Research (R & D) is essential to acquire useful data on BAER treatment effectiveness. The cost and complexity of using electronic equipment to get accurate measurements of water and sediment output mean that National Forest personnel alone cannot carry out this kind of detailed study; however, researchers interested in postfire rehabilitation do not currently have the resources (financial or personnel) to take advantage of new opportunities as they arise. We propose to establish a research "strike-team" that will have equipment and technical assistants available to quickly propose and set-up BAER effectiveness monitoring studies on wildfires where high-cost or controversial treatments are being employed. The team will be able to travel to fires anywhere in the western U.S.**

and set up monitoring studies in conjunction with and addition to those proposed by affected National Forests or BLM districts. Three to five intensive study areas could be established each year with this additional funding.

As an example of the kind of study we will conduct, paired catchments will be located after wildfire, and one catchment of each pair will be treated (e.g.with contour-felled logs, straw wattles, or sterile seed) according to best installation practices. Each catchment will contain a sediment basin/storage area and flume/weir with measurement equipment that will operate continuously. We will continuously monitor equipment status via cell phone or satellite, and data will be posted on our web site daily. Meteorological conditions will be measured using a standard solar powered RAWS (or similar) remote weather station. Comparisons will be made between the treated and untreated catchments on a storm-by-storm and cumulative basis. Catchments will be monitored for 3 to 5 years after the wildfire. A pilot study of this type is being set up this year in Montana using contour-felled logs.

Outcome or Products: **Progress reports and preliminary results will be provided to BAER coordinators and participating Forests. Peer-reviewed scientific publications on the effects of BAER treatments on runoff, erosion and sediment will be prepared. Technology transfer will occur via presentations at Regional BAER trainings, a Web site, guideline and summary articles in popular journals (e.g. *Fire Management Today*) and CD-ROMs.**

First Year: **Study design and progress reports; set up Web site.**

Second Year: **Initial publications, presentations, and Web site information.**

Three to Five Years Out: **Guidelines developed, further publications.**

Staffing Needs: **Plant Ecologist or Soil Scientist, GS-0408/0470-12/13 (1 SY), and GS-7 technician (2 TY).**

Description of Skills Required: **Hydrology and technical staff must have strong background in hydrology, fire ecology, and erosion mechanics. At least one technician will have botany/ecology training for vegetation assessment.**

Potential Partners: **National Forests and BLM districts with severely burned forest areas (to be identified as fires occur); Forest Service Wildlife, Fish and Watershed and Vegetation Management and Protection Research Programs, WO; FS Air and Watershed Staff; RMRS Missoula, MT; RMRS Fort Collins, CO; FS State and Private Forestry staff; Dept. of Army.**

Funding Requested: **$500,000**

Team Leaders:
Dr. Jan L. Beyers, Plant Ecologist, PSW; **Dr. Peter R. Robichaud, Res. Engineer, RMRS.**
Phone: **909-680-1527** **208-883-2349**
E-mail: **jbeyers@fs.fed.us** **probichaud@fs.fed.us**

Station**:** **PNW**

Proposal code**: PNW-6**

Topic(s): **B-i, (B-ii)**

Proposal title**:** **Predicting Potential Invasion and Spread of Invasive Species Following Fuel Reduction Treatments and Post-Fire Disturbance in the Interior Columbia River Basin**

Other proposals to which this is linked: **RMRS-FLG-5, RMRS-PRV-1, RMRS-MSO-8, RMRS-MSO-9**

RWU (or Program or Team) and location(s)**:**

Managing Natural Disturbance Regimes Program (PNW-4577)
Eastside Forest Health Restoration Team, Wenatchee, WA
Disturbance Ecology and Management Team, LaGrande, OR
Resource Management and Productivity Program (PNW-4163), Corvallis, OR

Description:

- Research or development question, issue, or need:

Effects on ecosystems and landscapes of catastrophic wildfires and non-native invasive species are two areas of increasing concern in the dry forest and woodland ecosystems of the intermountain West. A successful invasive species research and monitoring strategy requires the ability to predict potential invasive species and their pathways, and the development of risk assessment protocols that are useful to managers. Linking these concerns, we see a critical need for long-term studies on the effects of the recent severe fires and post-fire restoration efforts on incursion and spread of non-native invasive weeds and propose a comprehensive research strategy to address these needs. As management efforts target fuels reduction, we envision a corollary avenue of research assessing the effects of fuels reduction treatments, including thinning and prescribed burning, on incursion and spread of non-native invasive species. Our inability to predict expansion of invasive weeds following disturbance has the potential to severely curtail the use of prescribed fire and other silvicultural methods for reducing fuels.

- Research and development approach:

The following approaches to studying relationships between disturbances and invasive species will be used: (*i*) retrospective analysis of the effects of wildfire on differential competitive success between native species and invasive weeds; (*ii*) experimental projects to determine successional pathways of invasive species in burned, unburned, prescribed burned, and mechanically treated stands, and (*iii*) the evaluation, testing, refining, and further development of risk analysis protocols and models. Evaluating the efficacy of existing protocols, refining and developing an effective protocol through field-based

research across landscapes identified and mapped as key areas requiring invasive species management will be carried out collaboratively with land managers and scientists. Wilderness areas are under-researched and monitored for invasive species, yet are showing increased encroachment of weeds. Wilderness areas are also increasingly subject to large, stand-replacing fires that extend past wilderness boundaries into managed and human-dominated landscapes. We will include wilderness areas in evaluating and refining risk rating protocols both because invasives are an increasing threat to wilderness values and because wilderness can provide a reference for comparing invasive species dynamics to actively managed outside wilderness boundaries.

- Outcomes or products:
  - First year**: Development of a comprehensive study plan. Accumulate and report preliminary data on incursion and spread of invasive weeds into burned landscapes. Generate maps relating known centers of invasives to recent wildfires and proposed fuels reduction projects. Select and refine invasive species monitoring protocols and identify research sites.**
  - Second year: **Development and initial testing of options toward reducing threat of invasive species in restoration and fuels reduction efforts. Development of models and maps of relationships among invasive species, disturbance type/timing/history, and site attributes. First iteration of the validation of protocols for predicting invasive species risk.**
  - Three to Five years out**: Technology transfer of the increased understanding of relationships and interactions among wildfire, post-fire restoration, fuels reduction methods, and invasive species to assist managers in designing pre- and post-fire management alternatives that reduce the potential for spread of invasive weeds. Decision tools and maps for rating and comparing relative risk of restoration / management options. Findings will be transmitted via publications in refereed journals, station and technical publications, and technology transferred through workshops, reports, and meetings.**

Staffing needs by series and grade**:**

- **1 scientist GS-0460-13/14 or GS-0408-13/14 (Disturbance ecology, stand dynamics)**
- **1 professional GS-0462-9/11 (Geographic Information Systems)**
- **1 professional biological technician GS-0408-7/9 (invasive species ecology, taxonomy)**

Description of skills required**: The scientist requires the ability to organize, analyze, and synthesize complex data and communicate research results to a wide audience of concerned stakeholders. The GIS professional requires the ability to organize, analyze, model, and display complex GIS databases in the form of maps and charts. The professional biological technician requires the ability to organize and synthesize current information on invasive species, implement field-based data collection, and organize and analyze research data. The biological technician requires the ability to identify native and invasive species in the field, assist with data collection and management, and lead seasonal field personnel. The**

computer technician requires the ability to manage large amounts of data and assist the GIS professional in developing charts and maps.

Potential Partners**:**

- **Oregon State University; Washington State University; University of Washington; University of Idaho; University of Montana; Eastern Oregon University; Central and Eastern Washington Universities**
- **Rocky Mountain Research Station**
- **USDA Forest Service in Regions 1,4, and 6**
- **Bureau of Land Management**
- **State natural resources and agricultural agencies**
- **Department of Agriculture**
- **Native American Tribal entities,**
- **Blue Mountains Watershed Demonstration Area**
- **Center for Invasive Plant Management (Bozeman, MT)**

Funding requested**: $500,000 per year**

Team Leaders /Contacts**: John Lehmkuhl, Jane Hayes, Nan Vance / Ann Camp, Catherine Parks**
Phones**: 509 662-4315 (Lehmkuhl / Wenatchee); 541 962-6549 (Hayes / LaGrande); 541 750-7302 (Vance / Corvallis)**
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R&D PROPOSALS IN SUPPORT OF THE NATIONAL FIRE PLAN

Station**: RMRS**

Proposal code**: RMRS-PRV-1**

Topic(s)**: B. i, ii; C. i, iv**

Proposal title**. *Development, Performance, Classification, Seeding, and Availability of Native Plant Materials for Sagebrush Steppe and Pinyon-Juniper Community Restoration.***

Other proposals to which this is linked**: RMRS-RNO-1-3, RMRS-PRV-2, PNW-6**

RWU and location**: RMRS 4253, Provo, Utah**

Description**:**

- **Research or development question, issue, or need:**

With fire frequency and severity well above historic levels and increasing, fire and other disturbances require development and availability of plant materials for rehabilitation. In cases where restoration is the desired goal, native plant materials are needed and the performance of native plants at a project scale of restoration needs to be evaluated. The availability and characterization shrubs, grasses, and especially forbs are inadequate. Identification and characterization of lower level taxa (varieties and subspecies) and individual populations need to be established so that the benefits and risks of population transfer can be established. Seed sources and supplies and cultural seed production care of species need to be established so that seed supplies will be available when needed including working with land management agencies on seed warehousing needs and protocol. Fire tolerance or recovery of important shrub species might be enhanced by genetic manipulation of naturally occurring populations. Key individuals would include RMRS scientists, Durant McArthur (geneticist) and Steve Monsen (botanist) of RWU 4253; Nancy Shaw of RWU 4253; Valerie Hipkins of the USDA FS NFGEL Laboratory; and Stan Young of the Utah Crop Improvement Association..

- **Research and development approach:**

Determine the species with which we can effectively work with assistance from the land management community, establish and expand study sites for restoration and evaluation, develop seed handling protocols and standards and plant cultural characteristics, and establish and adapt molecular genetic protocols for population study.

- **Outcomes or products:**

The results of this research will be published and made widely available to the management community. These should provide land managers with a repertoire of options for maintaining natural diversity and productivity on rangelands and woodlands by providing a wider array of native plant materials and guidelines for their use.

- **First year: Cooperators identified, current studies expanded, new studies formalized and implemented, study sites located and suitable plant taxa identified, collected, and established in the greenhouse and study plots, currently available data synthesized, and first year's data collected and analyzed.**
- **Second year: Studies continue, prepare progress reports on plant materials development and genetic characteristics of study plants.**
- **Years 3-5: Expand studies and transmit results to users by field tours, presentations, and publication.**

Staffing needs by series and grade**:**

Existing Work Force: GM-0440-15 geneticist (partial assignment), GS-014-0430 botanist (partial assignment), GS-0435-14 physiologist (partial assignment), 0440-GS-12 geneticist (professional), ½ time, GS-0404-07 biological technician

New position(s): GS- 0440-12-geneticist, GS-0430-12 geneticist (professional)--increase incumbent from ½ to full time; GS-0404-05 biological technician.

Description of skills required**:**

A geneticist (scientist) with expertise in plant materials development, molecular genetics, and gene flow to be applied to the wide array of native shrubs, forbs, and grasses that will be identified and developed for restoration of the sagebrush steppe and pinyon-juniper ecosystems that are being degraded by increasing fire frequency and severity. The greenhouse—headhouse manager listed in proposal RMRS-4253-1 is also an important need.

Potential Partners:

RMRS 4252, RMRS 4353, Brigham Young University, Utah Division of Wildlife Resources, Forest Service NFGEL Laboratory, National Forest System Units, BLM-WO, BLM-UT, BLM-ID, ARS Forage and Range Laboratory, National Resource Conservation Service Plant Materials Centers and Specialists; State Germplasm experts.

Funding requested: **$500,000/year**

Team Leader: **E. Durant McArthur**
Phone: **(801) 377-5717**
E-mail: **dmcarthur@fs.fed.us**

Station: **RMRS**

Proposal code: **RMRS-MSO-9**

Topic(s): B-ii

Proposal title: *Dynamics of weed invasions and fire in the Northern Rockies.*

Other proposals to which this is linked: **RMRS-MSO-15, RMRS-MSO-7, RMRS-MSO-8, PNW-6**

Description:

- **Research or development question, issue, or need: Weeds are typically favored by disturbance, particularly disturbances such as fire that remove existing vegetation, expose soil, and increase forest floor light levels. Invasion of forests by weeds has recently become a critical management issue, but the extensive fires in Montana and northern Idaho in the summer of 2000 rendered entire landscapes at high risk to invasion. An unprecedented expansion of exotic weed species could dramatically alter successional pathways, fire regimes, herbivore carrying capacities, native plant and animal communities, and reduce or eliminate T&E species. There may be setbacks in weed management of areas where complexes of biocontrol agents were successfully established and controlled weed populations, but may have been reduced or exterminated by the fires**

Four RWUs in Missoula (4403, 4151, 4201, and the ALWRI) are studying aspects of weed ecology. By working collaboratively we can pool expertise and efficiently study interactions of weeds and fire on managed and wilderness systems, including key native plant and animal dynamics, and develop a suite of weed management strategies for land managers. This integrated research approach will result in risk assessments to determine which geographic areas, cover types, and habitats are most susceptible to weed invasion and which weed species are most invasive.

- **Research and development approach: Specific questions to be addressed include:**

- Have fire and fire-fighting efforts as well as post-fire rehabilitation projects resulted in new weed infestations? Can post-fire surveys and control efforts be used to prevent establishment and spread of any introduced species?
- What is the relative importance: of fire duration and intensity on susceptibility to weed invasion and expansion? of pre-burn weed density on weed invasion and expansion? of proximity to roads on weed invasion and expansion? of salvage logging and/or restoration on susceptibility to weed invasion and expansion? of cover or habitat types, moisture gradients, and light gradients on weed invasion and expansion? What is the rate and duration of weed invasion and expansion, and which species are most invasive?
- How have the fires affected populations of previously introduced biocontrol agents and their host weed species? How did this vary with respect to fire intensity and species of agents and hosts?

- **Outcomes or products:**
  - **First year: Weed species identification workshops for botanists and survey crews; Surveys of existing and new weed populations, and biocontrol agents (where they were previously introduced); Herbarium collections of weed species for vouchers and reference; Coordination program initiated with managers to reintroduce biocontrol agents and monitor.**
  - **Second year: Control effort recommendations to prevent establishment and spread of introduced species via eg., workshops with managers; GIS databases of geolocated weed populations**
  - **Three to Five years out: Workshops and publications communicating recommendations to minimize weed seed transport/establishment in future fire-fighting efforts; Publications evaluating aggressiveness of various weed species and recommendations for prioritization of control efforts; Publications regarding hazard analysis of susceptibility of native plant communities by different weed species and by fire severity; Publications regarding basic ecology of weeds and fire; Publications regarding landscape pattern analysis of weed invasions and fire**

Staffing needs by series and grade:
Existing: 0.25 SY GS-414-14 Research Entomologist, 0.25 TY, GS-460-9, Biologist with GIS specialty
New: 1 SY, GS-414-11 Postdoctoral Entomologist; 1 TY, GS-430-9 Botanist; 0.8 TY GS-430-5 Botanists (two, temporary, seasonal)

Description of skills required: **Senior Entomologist to guide efforts; Entomologist preferably with some management experience to interact with land managers; Computer specialist or Forester with strong GIS skills; Botanist with expertise in Northern Rocky mountain floras & ability to organize & lead field work; seasonal Botanists to perform plant monitoring.**

Potential Partners: **Steve Sutherland, RM-4403, Missoula; Peter Landres, ALWRI, Missoula; Dean Pearson, RM-4201, Missoula; at Montana State University, Jim Story, Jeff Littlefield , William Dyer, Matt Lavin, Dave Sands, Dave Casmer, Bruce Maxwell, Richard Aspinall; Bob Nowierski, Roger Sheely; Peter Rice, University of Montana; Tom Barbouletos, FHP, R-1/R-4, Weed Biocontrol Coordinator; Jim Olivarez, Range Management Leader, R-1; Dayle Bennett, Entomologist, FHP, R-4; Jerry Marks, Biocontrol Weed Coordinator, Montana Department of Agriculture; Steve Shelly, Region 1 Regional Botanist; Region 1 Botanists and Weed Control Crews; Montana and Idaho Weed Extension Agents**

Funding requested: **$150,000/year**

Team Leader: **George Markin, Bozeman**
Phone**: (406) 994-4892**
E-mail**: gmarkin@fs.fed.us**

Station: **RMRS**

Proposal code: **RMRS-FLG-5**

Topic(s): **B.ii, C.iv.**

Proposal title: ***Effects of wildfire and fire-management options on invasive and exotic weeds, insects, and pathogens in the Southwest.***

Other proposals to which this is linked : RMRS-FLG-1, 2, 3, 4, ; -PRV-1; PNW-6

RWU and location(s): **RMRS-4152, 4156, 4251 (all Flagstaff)**

Description:

- **Research or development question, issue, or need:** Ongoing studies of fire ecology in southwestern ponderosa pine forests have emphasized understory and overstory plant responses to catastrophic wildfires, and fire risk reduction treatments such as thinning dense stands or thinning plus prescribed burns. An important discovery is that many of these treatments have encouraged establishment of exotic and invasive weedy species in the post-disturbance flora. Some exotic species establish quickly on mineral soils following catastrophic wildfires. Another unwelcome treatment effect is the introduction, and possible naturalization, of noxious plants into the long-term flora.

  Likewise, wildfires or fire risk reduction treatments are likely to change the susceptibility of trees to forest insect pests and pathogens in ways that cannot currently be predicted. For example, the successful colonization of weakened trees by bark beetles could be a particularly important threat to the long-term sustainability of southwestern forests following wildfires or treatments designed to reduce future fire risk. Bark beetle epidemics that develop in areas of stressed trees can rapidly expand into nearby healthy trees and overwhelm the trees natural defenses through mass attacks. Outbreak populations of bark beetles can kill large areas of trees, thus increasing fuel loads and the risk of future catastrophic fires. Trees weakened by fire are also more susceptible to root pathogens.

  Another issue related to effects of wildfires on understory vegetation is the effectiveness of large-scale seeding programs used to control soil erosion following catastrophic fires. We have a poor understanding of what species should be used in seeding mixes to decrease the invasion of recently burned landscapes by exotic species. Furthermore, we understand even less about the influence of seeding programs on reestablishment of native and rare species following burning.

- **Research and development approach:** This proposal is part of a coordinated interdisciplinary approach to understand the ecological, economic, and social consequences of wildfire and associated rehabilitation efforts in southwestern ponderosa pine, pinyon-juniper, and mixed-conifer forests. Replicate plots will be randomly located in forested areas that represent different management options, such as unmanaged controls, areas burned by wildfires, burned areas that have been reseeded, thinned areas, prescribed burns, and areas that have been thinned and treated with prescribed fire. The focus will be on forested areas that are the most important to humans, such as the Wildland-Urban Interface and forests that have heavy recreational use.

The role of the plant ecologists, entomologists, and pathologists will be to examine how exotic and invasive plants and invertebrates, plus forest insects pests and pathogens, respond to wildfires and various fire-management options. We will also examine interactions of invasive and exotic weeds, insects, and pathogens with rare plants and animals, wildlife habitat, overstory and understory vegetation, fuels, soils, watershed condition, and associated aquatic and riparian systems.

- **Outcomes or products:**
  - **First year:** Provide forest managers/planners with a synthesis of information on the effects of wildfire and fire risk reduction treatments on invasive and exotic weeds, insects, and pathogens. Develop study plans, locate study areas, establish plots.
  - **Second year:** Identify and measure key indicators for invasive and exotic weeds, insects, and pathogens on study plots. These are "keystone", "dominant", or "pivotal" species that affect ecosystem structure and upon which the diversity of a large part of the community depends. Present preliminary results to forest managers/planners at conferences and workshops.
  - **Three to Five years out:** Continue to re-measure key indicators. Provide forest managers/planners with monitoring notebooks containing all the archival information from the study plots so that it is preserved for future reference and use. Provide better intermediate-term adaptive management guidelines for: 1) Fire risk reduction treatments, such as the timing and intensity of prescribed burns, thinning treatments, etc.; and 2) Post-fire rehabilitation treatments, such as reseeding mixtures that minimize invasion of exotics. Transfer technology to resource managers/planners through workshops, advisory committees, publications, and web sites.

Staffing needs by series and grade:

Existing workforce: Dr. Karen Clancy, GS-414-15; Dr. Will Moir, GS-408-14; Dr. Carolyn Sieg, GS-408-13, Dr. Brian Geils, GS-434-13, Dr. Ann Lynch, GS-414-13

New position(s): 1 SY, GS-408/414/430/434-12 post-doc; 4-6 TY, GS-404/462-5/7

Description of skills required: **A Research Ecologist/Entomologist/Botanist/Plant Pathologist to coordinate and manage the field sampling for invasive and exotic weeds, insects, and pathogens. Technician field crews will be needed to conduct the field sampling.**

Potential Partners: **Collaborators: Northern AZ Univ., The Arboretum at Flagstaff, The Nature Conservancy, Univ. of AZ, AZ State Univ., Univ. of NM, NM State Univ., and the Fire Science Labs at Missoula and Riverside. Partners: USFS NF & FHP in Reg. 2, 3, and 4; Grand Canyon Forests Partnership; APHIS; BLM; BIA; NPS; Forestry Divisions in AZ, NM, UT, & CO; AZ and NM Land, Agr., & Nat. Res. Depts.; AZ & 4-Corners Sustainable Forests Partnership.**

Funding requested: **$500,000/year**

Team Leader: **Dr. Karen Clancy, Res. Entomologist/Project Leader, RMRS-4152**
Phone: **520-556-2105**
E-mail: **kclancy@fs.fed.us**

Station: **RMRS**

Proposal code: **RMRS-RNO-3**

Topic(s): **B**

Proposal Title: ***Determining the Environmental and Ecological Factors that Make Great Basin Watersheds Susceptible to Invasive Plant Species***

Other Proposals to which this is linked: **RMRS-RNO-1 and 2, -PRV-1**

RWU and location: **RWU-4252, Reno, Nevada**

Description:

- **Research or development question, issue, or need:**

Fire-adapted invasive species, especially the exotic annual, cheatgrass, are increasing in abundance throughout Great Basin watersheds and are resulting in dramatic increases in fire frequency, intensity and size. The invasive species-fire cycle is causing the conversion of woodland and shrubland ecosystems to homogenous landscapes dominated by the invasives, and is having highly negative effects on both watershed and riparian ecosystem integrity. In addition, the invasive species are greatly increasing the difficulty of either rehabilitation or restoration following fire. To date, the focus of both research and management has been on specific methods for controlling these species following fire/invasion. Consequently, we still know very little about which ecosystems and vegetation states are most susceptible to invasion by these species or about how fire influences the invasion process. Increasing our understanding of the environmental and ecological factors that determine susceptibility to invasion will allow us to develop management techniques, including prescribed fire, aimed at preventing initial invasion or expansion. This approach may be as or more effective than management schemes designed to reduce or eliminate established populations of invasive species.

- **Research and development approach:**

This research would examine key factors influencing community susceptibility to the invasion and spread of invasive species in the Great Basin, beginning with the fire-adapted, exotic annual grass, cheatgrass (*Bromus tectorum*). It would address the hypothesis that most communities become more susceptible to exotic species invasion as a result of an increase in resource availability, such as occurs following fire and/or degradation by previous disturbance or land use activities. Specifically, it would evaluate the effects of resource availability (i.e., nutrients, water) as influenced by environmental gradients, fire, and community condition or health on invasive species establishment, reproduction, and expansion. It would evaluate the problem on both a local and regional basis, and would include an examination of functional or "healthy" communities, communities at risk of conversion to invasive species, and revegetated communities. This research would be

highly integrated with the invasive species component of RMRS-4252-2 "Using Historical and Current Data to Develop Effective Fire/Fuels Management Programs for Pinyon-Juniper and Sagebrush Steppe Ecosystems," and would provide important information on watershed response to disturbance for RMRS-4252-1, "Predicting Watershed Response to Fire in Pinyon-Juniper Dominated Ecosystems in the Great Basin." Key individuals would include RMRS plant ecologist Jeanne Chambers and range scientist Robin Tausch, and ARS soil scientist Bob Blank. This work would be a collaborative effort with RMRS-4253.

- **Outcomes or products: This research would provide much needed information on the effects of fire and community health on plant species invasion, the types of management activities likely to increase/decrease community susceptibility to invasion, and the types of fire and non-fire treatments useful for restoring more diverse communities.**
- **First Year: Cooperators selected, study plans completed, and first year's data collected and analyzed.**
- **Second Year: Effects of resource availability, environmental gradients, and community condition on invasive processes determined and initial results reported.**
- **Third to Five years out: Additional study locations added to evaluate a wider range of conditions and communities. Field tours conducted to transmit results to potential users, and results reported in both applied and technical outlets.**

Staffing needs by series and grade:

Existing workforce: GS-408-14 ecologist, GS-454-14 range scientist
New position(s): One permanent, full time technician, GS-404-05/06

Description of skills required: **plant ecology, soil ecology, nutrient cycling, restoration ecology**

Potential partners: **RMRS-4253, ARS, Utah State University, Brigham Young University, University of Nevada, Reno, Nevada, Utah and Idaho BLM, Region 4, Forest Service**

Funding requested**: $150,000/year**

Team Leader: **Jeanne C. Chambers**
Phone: **(775) 784-5329**
Email**: jchambers@fs.fed.us**

Station: **RMRS**

Proposal code: **RMRS-FTC-3**

Topic(s): **B[i,ii]; C[iv]**

Proposal title: ***Patterns of white pine regeneration after fire and its implications for forest establishment and spread of white pine blister rust***

Other proposals to which this is linked: RMRS-FTC-4 and RMRS-FTC-6.

RWU and location(s): **RWU4451, Ft. Collins, CO**

Description:

- **Research or development question, issue, or need:**

The combination of the recent fires within the range of white pines and the discovery of white pine blister rust, an exotic pathogen, in 1998 in Northern Colorado has accelerated our need to understand the regeneration dynamics of white pines. White pine blister rust has devastated natural western white pine forests in the Pacific Northwest and is currently causing extensive mortality of whitebark and limber pine in Canada, Montana and Wyoming. It is clear that this exotic pathogen spreads and infects trees even in dry climates, putting limber and bristlecone pine at risk in the Central Rocky Mountains.

The urgency for white pine research is four fold: (1) white pines are important pioneer species after fire serving to facilitate development of commercially-valuable forest types and to protect watersheds from soil erosion and rapid snowmelt, yet very little is known about the biophysical conditions that affect regeneration dynamics of these species. (2) White pine seedlings infected with the blister rust die soon after infection yet it is unknown what impact the additional stress of this exotic pathogen will have on the establishment dynamics of white pines. (3) The cover by the obligate alternate host for white pine blister rust (Ribes) can be greatly increased following fire, further increasing the risk of spread of the disease. (4) There are no guidelines available for selecting appropriate seed sources if we are to assist regeneration of white pines in burned areas in the future. Building on Schoettle's past research conclusions that the growth of Rocky Mountain white pines (limber, bristlecone, and whitebark pines) along elevation gradients differ from that of other Rocky Mountain conifer species, we suspect that the genetic structures of these species are not predictable from work conducted on other species.

- **Research and development approach:**

An interdisciplinary approach will be applied to determine the biophysical, physiological and genetic factors affecting successful white pine regeneration in burns. Regeneration success will be researched as it relates to environmental factors, incidence of white pine blister rust, and restoration treatments using a combination of new permanent plots in the Colorado burns, existing research plots in the Yellowstone fires of 1988, and experimentation in the field and controlled environments. Schoettle and colleagues will also conduct experimentation to determine the transferability of limber and bristlecone seed across environmental gradients for successful establishment and restoration.

- **Outcomes or products:**
- **First year:**

Quantify establishment patterns of trees and the incidence of white pine blister rust infection on seedlings/saplings 10 years after fire at Yellowstone. Install regeneration plots in the Colorado burns. Collect seeds for the seed transfer study.

- **Second year:**

Report on the regeneration patterns of whitebark pine and limber pine and the effects of blister rust after the Yellowstone fires. Study the physiology, carbon relations, and pathology of seedlings in the new Colorado plots in relation to site factors and restoration treatments. Installed seed transfer study in burned areas and under controlled conditions.

- **Three to Five years out:**

Report on the timing of seed dispersal, germination and establishment of wind- and bird-dispersed seeds for the first years following the Colorado burns. On-going physiological studies of seedlings in the seed transfer study and field regeneration plots.

- **Five to Ten years out:**

Report on the seed transfer study for limber pine and bristlecone pine along environmental gradients. Report on the predictive capability to estimate regeneration success in burns in relation to environmental factors. Report on the estimated rate of spread of white pine blister rust among seedlings in large burns. Provide data for application in quantitative models and development of restoration options.

Staffing needs by series and grade:

Existing: 0.3 SY per year Plant Physiological Ecologist (Schoettle) GS-435-14; collaborating RWU4451 Plant Pathologist and Silviculturist.
New Permanent staff: 1 Professional Year per year (GS-435 or 404-9/11).

Description of skills required: **Plant Physiological Ecology, Seed-dispersal Ecology, Plant Pathology, Population Ecology, Population Genetics, GIS, and Silviculture.**

Potential Partners: **RWU4451 and RMRS scientists, R2, NFS, U. of CO. - Denver, USDA-ARS, R2 White Pine Health Team (established in 1999; individuals from R2, Forest Health Technology Enterprise Team, State Forest Health programs, and RMRS and area Universities).**

Funding requested: **$175,000/year**

Team Leader: **Anna W. Schoettle (GS-435-14)**
Phone: **970-498-1333**
E-mail: **aschoettle@fs.fed.us**

Station: RMRS

Proposal code**: RMRS-ABQ-5**

Topics: **B-ii, Di**

Title: *Evaluating the Role of Grassland Fire in Southwestern Steppe, Colorado Plateau, and Chihuahuan Desert Grasslands to Manage Exotic and Woody Plants*

Other proposals to which this is linked: **RNO-2,3, PRV-1, ABQ-3, 4**

RWU: **RWU 4351 and 4652 (Albuquerque), RWU 4853 (Albuquerque)**

Description:

- **Research or development question, issue, or need:** (1) How do current fire frequency patterns and grassland ecosystem conditions differ from historic patterns and conditions, and how do fire effects interact with grassland changes caused by other management practices such as grazing and minerals development? (2) What practices are most effective for controlling selected exotics, ensuring a balance of woody and herbaceous plants, and increasing herbaceous plant cover where needed? (3) What important, rare, or endangered plant and animal species will be affected by fire management practices in grasslands, and how can practices be modified to maintain or increase populations of such species? (4) What are the economic and social consequences of vegetation change and management to communities and user groups, and what are their preferences for vegetation management using fire?

- **Research and development approach:** Increasingly, woody plants such as mesquite, shinnery oak and juniper, and exotic plants including thistles, knapweeds, leafy spurge, and annual grasses have invaded national grasslands, desert grasslands, foothills, and mountain grasslands, resulting in widespread shifts in plant and animal species composition and general decreases in grass cover and grassland acreage. This trend may be caused by factors such as fire suppression, heavy livestock grazing, changes in climate, and spread of exotic weeds. Exotic and woody plants are often unpalatable, may differ in value to wildlife species, can reduce biological diversity (e.g., monotypic conversion), may be more (or less) susceptible to fire, and may alter fire frequency. In addition, several threatened, endangered, and state-listed species occupy southwestern grasslands including black-tailed prairie dog (petitioned, under litigation), lesser prairie chicken (T/E listing determined as “merited”), mountain plover (expected listing in 2001: Threatened), cactus ferruginous pygmy-owl (Endangered), and long-nosed bat (Endangered). These species are likely to be detrimentally affected by type conversion to habitats dominated by exotics and may also be affected by prescriptions designed to control exotics. Research is needed to evaluate methods for restoring grasslands to conditions favoring herbaceous plants, to control exotic invasive plants, and to determine appropriate management practices, including prescribed fire, in grassland settings that support threatened and endangered species. Research is also needed to assess local community and stakeholder preferences in restoration approaches. More specifically, our research will 1) quantify plant, wildlife, and rare species responses to

conversion of grasslands to shrublands; 2) assess different methods for restoring grasslands altered by invasive exotic or woody plants; 3) assess efficacy of fire treatments in different seasons and at different frequencies to restore habitats needed by TES and other species, and reduce invasive populations; and 4) establish grassland fire histories, and assess human needs and preferences, in order to reduce conflict over vegetation management. Exotic or invasive plant species of special concern in Chihuahuan Desert, Colorado Plateau, and Southwestern short-grass steppe include Malta starthistle, Russian knapweed (displaces native bunchgrasses), musk thistles, Lehman's lovegrass, red brome, and broom snakeweed.

In Regions 2 and 3, we have already identified research and cross-comparison sites on the Kiowa, Cimarron, and Comanche National Grasslands; Cibola National Forest (Bernallilo Watershed), and Sevilleta and Jornada Long-Term Ecological Research (LTER) sites.

- **Outcomes or products:**
  - **First year:** Site selection, prioritization of exotic/noxious plants in Southwest, data collection, year-end report. Update web site (http://www.fs.fed.us/abq). ``research, and contact communities and user groups.
  - **Second year:** Implement control/restoration treatments, post data on web site, prepare video of networked sites, host congressional-cooperator-RMRS-WO field tours. Conduct social research.
  - **Three to Five years out:** Complete historical and social research. Post-treatment monitoring, publish findings in refereed journals, on-line database, develop training and tech-transfer workshops, model fire effects, prepare and rotate posters to districts.

Staffing Needs**:** Existing workforce: **1/3 scientist-yr Botanist/Ecologist (Rosemary & Burt Pendleton); ½ scientist-yr Ecologist Paulette Ford, 1/5 scientist-yr Wildlife Biologist Deborah Finch; 1/4 scientist-year each, Carol Raish and Richard Periman.**

Description of skills required: **For scientist positions, a Ph.D. in range science, botany, biology, natural resources, or ecology is required, in addition to knowledge of plant identification in the Southwest, plant reproductive ecology, rangeland fire science, and statistical design and analysis. Ph.D. scientists in archaeology, history, and social science are needed also. Range or biological technicians: knowledge of plant taxonomy & identification in Southwestern grassland and shrubland ecosystems and range-plant sampling techniques.**

Potential Partners: **Regions 2, 3 (Cibola National Forest, Kiowa, Comanche, Cimarron National Grasslands), Sevilleta and Jornada LTER Sites, University of New Mexico, Sevilleta National Wildlife Refuge, New Mexico State University, BLM, Tribes.**

Funding Requested**: $200,000/year**

Team Leader: **Deborah Finch**
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